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ART UNIT	**PAPER NUMBER**
2628	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/653,791	OHBA, AKIO	
	Examiner	Art Unit	
	Jason M. Repko	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7 and 9-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7 and 9-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 March 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 1/06; 3/06

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The replacement drawings were received on 3/16/2006. These drawings are accepted. The outstanding objections to the drawings are withdrawn.

Specification

2. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: Claim 27 recites the limitation "sharing algorithm"; this terminology does not appear in the descriptive portion of the specification.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 22 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. Claim 22 recites the limitation "the program" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1, 3, 5, 20, 25, and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,016,150 to Lengyel et al.

8. With regard to claim 1, Lengyel et al discloses "an image processing apparatus comprising:

a. a grouping unit which selects rendering strategy according to characteristics of input three-dimensional objects (*lines 4-7 of column 10: "Preferably, the scene should be factored to identify scene elements (or sets of scene elements) that can be rendered to separate layers at different update rates and spatial resolution."*; *lines 33-38 of column 10 (emphasis added): "Geometry factoring should consider the following properties of objects and their motions: 1. Relative velocity 2. Perceptual distinctness 3. Ratio of clear to "touched" pixels."*) and groups the three-dimensional objects into groups in such a manner that the three-dimensional objections to which the same rendering strategy is applied are grouped into the same group (*line 66 of column 10 through line 2 of column 11: "Background elements should be blurred by using a lower sampling rate. The main actor requires more samples in space and time. In order to make such tradeoffs, perceptually distinct objects must be separated into layers."*);

b. a rendering processing unit which derives a subspace which contains the three-dimensional objects belonging to the same group to be an independent rendering unit and performs rendering processing individually on the subspace by applying the group by group different rendering strategy (*lines 15-17 of column 6: "In a layered pipeline, the spatial resolution of each of the layers can differ from each other and from the resolution of the output image."*; *lines 24-25 of column 6: "The temporal resolution of each of the*

layers can also vary from one another and from the display update rate."), and generates independent image data for each subspace (*lines 7-12 of column 6: "Unlike the traditional frame buffer approach, the layered pipeline splits the scene into separate layers (e.g., 36 and 38), each with independent quality parameters 40-42, and can render these layers at independent spatial and temporal resolution."*);

c. and a consolidation unit which generates final output image data to be displayed by consolidating the image data generated for each subspace (*lines 57-60 of column 8: "The compositor receives the sprites and the layering order as input, and combines pixels in the sprites at corresponding screen coordinates into final pixel values."*).

9. With regard to claim 3, Lengyel et al discloses "the grouping unit, based on motion characteristics of the three-dimensional objects (*lines 33-38 of column 10 (emphasis added): "Geometry factoring should consider the following properties of objects and their <u>motions</u>..."*), selects the rendering strategy on whether motion blurring processing is applied or not, and groups the three-dimensional objects to which the motion blurring processing is applied, into the same group" (*lines 26-31 of column 16 (emphasis added): "For a <u>linear motion blur effect</u>, the sprite sampling along one of the axes may be reduced to blur along that axis. The sprite rendering transformation should align one of the coordinate axes to the object's velocity vector by setting the bounding slab directions to the velocity vector and its perpendicular."*).

10. With regard to claim 5, Lengyel et al discloses "the grouping unit, based on information related to level of detail in rendering the three-dimensional objections, selects the rendering strategy in which multi-resolution rendering is applied at a resolution depending on the level of detail, and groups the three-dimensional objects to be rendered at the same resolution into the

same group" (*line 66 of column 10 through line 2 of column 11: "Background elements should be blurred by using a lower sampling rate. The main actor requires more samples in space and time. In order to make such tradeoffs, perceptually distinct objects must be separated into layers."; lines 54-57 of column 10: "Second, layered rendering more optimally targets rendering resources. Less important layers can be rendered at a lower spatial and temporal resolution to conserve resources for important layers."*).

11. With regard to claim 20, Lengyel et al discloses "an image processing method comprising grouping a plurality of three-dimensional objects into groups (*lines 4-7 of column 10; lines 33-38 of column 10*) in such a manner that the three-dimensional objects to which same rendering strategy is applied are grouped into the same group (*lines 43-46 of column 10; line 66 of column 10 through line 2 of column 11*) and performing rendering processing individually on a subspace which contains at least one of the three-dimensional objects belonging to the same group by applying the group by group different rendering strategy (*lines 15-17 of column 6*; *lines 24-25 of column 6; lines 7-12 of column 6*), and generating final image data to be displayed by consolidating rendering data of each subspace (*lines 57-60 of column 8*).

12. With regard to claim 25, Lengyel et al discloses "the rendering strategy is a rendering algorithm applied to the three-dimensional objects" (*lines 2-6 of column 6: "FIG. 2 is a diagram depicting a layered graphics rendering pipeline 30. Like a traditional frame buffer approach, the input to the pipeline is a 3D scene 32 describing the position and visual attributes of the graphical objects in the scene."*).

13. With regard to claim 26, Lengyel et al discloses "the rendering algorithm is a hidden surface removal algorithm" (*lines 43-45 of column 29: "The tiler 236 performs scan-conversion,*

shading, texturing, hidden-surface removal, anti-aliasing, translucency, shadowing, and blending for multi-pass rendering.").

14. **Claims 19 and 33 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,867,166 to Myhrvold et al.**

15. With regard to claim 19, Myhrvold et al discloses "an image processing method comprising dividing a space into subspaces (*lines 18-24 of column 9: "A scene, or portions of a scene, can be divided into pixel regions (32×32 pixels in one specific implementation), called chunks. In one implementation, the system divides the geometry assigned to gsprites into chunks, but an alternative implementation could perform chunking without gsprites. The geometry is presorted into bins based on which chunk the geometry will be rendered into."*) which overlap one another (*lines 26-27 of column 9: "Geometry that overlaps a chunk boundary is preferably referenced in each chunk it is visible in."*) and performing rendering processing independently by subspace unit on a three-dimensional object in each of the subspaces (*lines 43-46 of column 4: "In the context of 3-D animation, the scene is comprised of objects that intersect a view volume. Objects in the view volume for a current image are assigned to gsprites and are rendered independently to their corresponding gsprites."*) to generate rendering data having depth information on a pixel by pixel basis (*lines 37-41 of column 67: "...and Z is the Z-value which represents the depth of the pixel from the eye point, M is a 4×4 pixel coverage bitmask for each pixel which is partially covered..."*), and consolidating the rendering data of the three dimensional object in each of the subspaces by evaluating a distance in depth direction on a pixel by pixel basis" (*lines 12-16 of column 66: "To perform hidden surface removal, the pixel engine*

406 compares depth values for incoming pixels (fully covered pixels or pixel fragments) with pixels at corresponding locations in the pixel or fragment buffers").

16. With regard to claim 33, Myhrvold et al discloses "an image processing apparatus comprising:

d. a grouping unit which groups input three-dimensional objects into groups (*lines 43-46 of column 4: "In the context of 3-D animation, the scene is comprised of objects that intersect a view volume. Objects in the view volume for a current image are assigned to gsprites and are rendered independently to their corresponding gsprites."; lines 19-23 of column 9: "In one implementation, the system divides the geometry assigned to gsprites into chunks... "*);

e. a rendering processing unit which derives a subspace which contains the three-dimensional objects belonging to the same group to be an independent rendering unit (*lines 20-24 of column 9: " The geometry is presorted into bins based on which chunk the geometry will be rendered into."*) and performs rendering processing individually on the subspace (*lines 49-51 of column 7: "These image layers, which we refer to as generalized gsprites, or gsprites, can be rendered into and manipulated independently."; lines 24-26 of column 14: "After an object or objects are assigned to gsprites, the image processor divides the gsprites into image regions called 'chunks' (248)."*), and generates independent image data having per-pixel Z values indicating depth information on a pixel by pixel basis for each subspace (*lines 37-41 of column 67: "...and Z is the Z-value which represents the depth of the pixel from the eye point, M is a 4×4 pixel coverage bitmask for each pixel which is partially covered... "*); and

f. a consolidation unit which generates final output image data to be displayed by performing Z-merge processing of the image data generated for each subspace according to the per-pixel Z values (*lines 12-16 of column 66: "To perform hidden surface removal, the pixel engine 406 compares depth values for incoming pixels (fully covered pixels or pixel fragments) with pixels at corresponding locations in the pixel or fragment buffers"*).

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

18. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

19. **Claims 2, 4, 6, 21, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,016,150 to Lengyel et al.**

20. With regard to claim 2, Lengyel et al discloses a viewing frustum (*lines 9-12 of column 22: "As described above, the preprocessor clips characteristic bounding polyhedron to a viewing frustum that extends beyond the screen boundary (the expanded sprite extent)."*) and a coordinate transform unit and rendering unit (*lines 25-27 of column 12: "The renderer 100 independently*

renders the fully illuminated layer by rendering a fully illuminated scene from the perspective of the viewpoint.") for transforming the three-dimensional object to screen space and rendering the image (*lines 12-16 of column 15: "When creating a sprite image, we must consider a new transform in the standard pipeline in addition to the modeling, viewing, and projection transforms: a 2D transformation that transforms samples in sprite coordinates to screen coordinates."; lines 25-28 of column 15: "FIG. 8 is a diagram illustrating an example of mapping an object 120 from modeling coordinates 121 to sprite coordinates 122, and then mapping the object 120 from sprite coordinates to the screen coordinates 123."*).

21. Lengyel et al does not explicitly disclose "a quadrangular truncated pyramid." Official Notice is taken that both the concept and the advantages of providing quadrangular truncated pyramid for perspective transformation and rendering of three-dimensional objects are well known and expected in the art. It would have been obvious to have included a quadrangular truncated pyramid in Lengyel et al as quadrangular truncated pyramids are known to provide a boundary for the viewable space of a virtual scene that is analogous to the visible volume of space in real-world image formation processes. Therefore, it would have been obvious to one of ordinary skill in the art to obtain the invention recited in claim 2.

22. Claim 4 recites limitations similar in scope to those of claim 3. Claim 4 is rejected with the rational of claim 3.

23. Claim 6 recites limitations similar in scope to those of claim 5. Claim 6 is rejected with the rational of claim 5.

24. With regard to claim 21, Lengyel et al discloses "a storage medium storing a computer program executable by a computer, the program comprising:

g. selecting a rendering strategy according to characteristics of the three-dimensional objects (*lines 4-7 of column 10: "Preferably, the scene should be factored to identify scene elements (or sets of scene elements) that can be rendered to separate layers at different update rates and spatial resolution."*);

h. grouping the three-dimensional objects which exist in a display area into groups in such a manner that the three dimensional objects to which the same rendering strategy is applied are grouped into the same group (*lines 33-38 of column 10: "Geometry factoring should consider the following properties of objects and their motions: 1. Relative velocity 2. Perceptual distinctness 3. Ratio of clear to "touched" pixels."; line 66 of column 10 through line 2 of column 11*);

i. deriving a subspace which contains the three-dimensional objects belonging to the same group to be an independent rendering unit; performing rendering processing individually by subspace unit by applying the group by group different rendering strategy to generate image data for each subspace (*lines 15-17 of column 6*; *lines 24-25 of column 6; lines 7-12 of column 6*); and

j. generating final image data to be displayed in the display area by consolidating the image data generated for each subspace (*lines 57-60 of column 8*).

25. Lengyel et al discloses reading the scene and breaking the object into parts (*lines 13-15 of column 10: "The first step 70 is to break the scene into "parts" such as the base level joints in a hierarchical animated figure."*). Lengyel et al does not expressly disclose "reading array data of a plurality of three-dimensional objects." Official Notice is taken that both the concept and the advantages of providing an array for reading three-dimensional objects of a scene are well

known and expected in the art. It would have been obvious to have included the operation of reading array data in Lengyel et al as arrays are known to provide a random access data retrieval and a simple implementation. Therefore, it would have been obvious to one of ordinary skill in the art to obtain the invention recited in claim 21.

26. With regard to claim 22, Lengyel et al discloses the limitations of parent claim 21. Lengyel et al discloses "calculating a position of each of the three-dimension objects in a viewpoint coordinate system" (*line 65 of column 6 through line 3 of column 7: "In FIG. 2, the input 32 to a layered pipeline includes the set of 3D objects in the scene, and the position of objects, light sources, and the viewpoint for the scene. In the context of animation, the position of objects, light sources and the viewpoint can be time-varying, in which case, the position of these scene elements are represented as functions of time."*) "and determining information related to level of detail in rendering each of the three-dimensional objects based on a distance from the viewpoint, and wherein said grouping groups the three-dimensional objects which exist in the display area into the groups according to the information related to level of detail (*line 66 of column 10 through line 2 of column 11: "Background elements should be blurred by using a lower sampling rate. The main actor requires more samples in space and time. In order to make such tradeoffs, perceptually distinct objects must be separated into layers."; lines 54-57 of column 10: "Second, layered rendering more optimally targets rendering resources. Less important layers can be rendered at a lower spatial and temporal resolution to conserve resources for important layers."*).

27. **Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,016,150 to Lengyel et al in view of U.S. Patent No. 5,986,659 to Gallery et al.**

28. With regard to claims 28 and 29, Lengyel et al discloses "the grouping unit, based on information related to level of detail in rendering the three dimensional objects, selects the rendering strategy which defocus processing is applied, and groups the three-dimensional objects to which the defocus processing is applied" (*line 66 of column 10 through line 2 of column 11: "Background elements should be blurred by using a lower sampling rate. The main actor requires more samples in space and time. In order to make such tradeoffs, perceptually distinct objects must be separated into layers."*). Lengyel et al does not disclose a "focus depth depending on the level of detail." Gallery et al discloses a "defocus processing is applied at a focus depth depending on the level of detail" (*lines 10-16 of column 3: "Specifying a point of focus P (a depth value at the place in the image that the observer is looking at), in order to give the appearance of focus/de-focus it is assumed that for pixels in the image with depth close to that of the point of focus the image should be sharp, but, as the depth of a pixel gets further away from the depth of the point of focus (whether nearer or closer to the position of the observer) then the image should become more blurred."*).

29. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to perform defocus processing at a focus depth as taught by Gallery et al in the system and method disclosed by Lengyel et al. The motivation for doing so would have been to model the process of image formation of a physical camera, thereby improving the realism of the resulting images as suggested by Gallery et al "Synthetically generated computer graphics images

normally suffer from the deficiency of being uniformly sharp, i.e. all parts of the image appear to be in focus" (lines 10-12 of column 1). Therefore, it would have been obvious to combine Gallery et al with Lengyel et al to obtain the invention specified in claim 28 and 29.

30. **Claims 9-14, 17, 18, 23, 24 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,016,150 to Lengyel et al in view of applicant's admitted prior art Kwan Liu Ma, James S. Painter, Charles D. Hansen, Michael F. Krogh, "A data distributed, parallel algorithm for ray-traced volume rendering," October 25, 1993, Proceedings of the 1993 Symposium on Parallel Rendering, p.15-22 (herein referred to as "Ma et al.").**

31. With regard to claims 9 and 10, Lengyel et al shows the limitations of the parent claim 1, but does not disclose a distributed system. Ma et al teaches "the rendering processing unit comprises a plurality of rendering units (*first paragraph of section 4: "Currently, the data distributor runs as a single 'host' process that determines the partitions of the data set, reads the data set piece by piece from disk and distributes it to a set of 'node' processes that perform the actual rendering and compositing.*") and distributes the rendering processing to the plurality of the rendering units according to complexity level of the rendering processing by subspace unit" (*third paragraph of section 6: "The data subdivision can be done unevenly, taking into account the predicted capacity on each machine to try to balance the load."*).

32. With regard to claims 11 and 12, the Lengyel et al shows the limitations of parent claim 1, but does not disclose a distributed system. Ma et al teaches "the rendering processing unit comprises a plurality of rendering units (*shown in the rejection of claims 9 and 10*) with different processing performance and assigns the rendering processing to the plurality of the rendering

units, each of which has the appropriate processing performance corresponding to complexity level of the rendering processing by subspace unit" (*third paragraph of section 6: "Alternatively, the data can be subdivided into larger number of equal sized subvolumes and the more capable machines can be assigned more than one subvolume."*).

33. With regard to claims 13 and 14, Lengyel et al shows the limitations of parent claim 1, but does not disclose a distributed system. Ma et al teaches "a communication unit which receives image data rendered by subspace unit from an external distributed rendering processing device connected with the apparatus via a network" (*first paragraph of section 3.3: "Each computer can perform ray tracing independently; that is, there is no data communication required during the sub volume rendering."; fourth paragraph of section 3.4: "In our example, as shown in (b), Computer 1 keeps only the left half-image and sends its right half-image to its immediate right sibling, which is Computer 2."*), and "wherein the consolidation unit consolidates the image data received from the external distributed rendering processing device with the image data generated by the rendering processing unit and generates the final output image data to be displayed" (*first paragraph of section 3.4: "The final step of our algorithm is to merge ray segments and thus all partial images into the final total image."*).

34. With regard to claim 17, Lengyel et al discloses "an image processing system including a:

k. a grouping unit which selects rendering strategy according to characteristics of input three-dimensional objects (*lines 4-7 of column 10*; *lines 33-38 of column 10*) and groups the three-dimensional objects into groups in such a manner that the three-

dimensional objects to which the same rendering strategy is applied are grouped into the same group (*lines 43-46 of column 10*; *line 66 of column 10 through line 2 of column 11*);

l. a rendering processing unit which derives a subspace which contains the three-dimensional objects belonging to the same group to be an independent rendering unit and performs rendering processing individually on the subspace by applying the group by group different rendering strategy (*lines 15-17 of column 6*; *lines 24-25 of column 6*), and generates independent image data for each subspace (*lines 7-12 of column 6*);

m. and a consolidation unit which generates final output image to be displayed by consolidating the image data generated for each subspace (*lines 57-60 of column 8*).

35. Lengyel et al does not disclose a distributed system. Ma et al teaches "plurality of image processing apparatus for exchanging information with each other via a network and performing distributed rendering processing," (*fourth paragraph of section 3.4: "In our example, as shown in (b), Computer 1 keeps only the left half-image and sends its right half-image to its immediate right sibling, which is Computer 2."; first paragraph of section 4.2: "Thus, using a set of high performance work stations connected by an Ethernet, our goal is to set up a volume rendering facility..."*). Furthermore, Ma et al teaches that grouping, the rendering processing and the consolidation are functionally distributed among the plurality of the image processing apparatus (*first paragraph of section 3.3: "Each computer can perform ray tracing independently; that is, there is no data communication required during the sub volume rendering."; first paragraph of section 4: "Currently, the data distributor runs as a single 'host' process that determines the partitions of the data set, reads the data set piece by piece from disk and distributes it to a set of 'node' processes that perform the actual rendering and compositing."*)

36. With regard to claim 18, Lengyel et al discloses "an image processing apparatus comprising:

n. a grouping unit which selects rendering strategy according to characteristics of input three-dimensional objects (*lines 4-7 of column 10*; *lines 33-38 of column 10*) and groups the three-dimensional objects into groups in such a manner that the three-dimensional objects to which the same rendering strategy is applied are grouped into the same group (*lines 43-46 of column 10*; *line 66 of column 10 through line 2 of column 11*);

o. a rendering processing unit which derives a subspace which contains the three-dimensional objects belonging to the same group to be an independent rendering unit and performs rendering processing individually on the subspace by applying the group by group different rendering strategy (*lines 15-17 of column 6*; *lines 24-25 of column 6*), and generates independent image data for each subspace (*lines 7-12 of column 6*);

p. and a consolidation unit which generates final output image to be displayed by consolidating the image data generated for each subspace (*lines 57-60 of column 8*).

37. Lengyel et al does not disclose a distributed system with distributed functional blocks. Ma et al discloses "an image processing apparatus for exchanging information with other apparatus via a network" (*first paragraph of section 4.2: "Thus, using a set of high performance work stations connected by an Ethernet, our goal is to set up a volume rendering facility..."*) and "processing result by the function block which is not included in this apparatus is received from the other apparatus and utilized" (*first paragraph of section 4: "Currently, the data distributor runs as a single 'host' process that determines the partitions of the data set, reads the data set piece by piece from disk and distributes it to a set of 'node' processes that perform the actual*

rendering and compositing.") The data distributor on the "host process" as taught by Ma et al, performs the grouping function, which is separated from and utilized by the rendering and compositing on the "node processes."

38. With regard to claim 23, Lengyel et al discloses the limitations of parent claim 21, respectively, but does not disclose a distributed system. Ma et al discloses "the rendering processing are performed in such a manner that the rendering processing for each subspace is distributed to a plurality of rendering processing units" (*first paragraph of section 4: "Currently, the data distributor runs as a single 'host' process that determines the partitions of the data set, reads the data set piece by piece from disk and distributes it to a set of 'node' processes that perform the actual rendering and compositing."*).

39. Claim 24 recites limitations similar in scope to those of claim 23. Claim 24 is rejected with the rational of claim 23.

40. With regard to claim 27, Lengyel et al discloses the limitations of parent claim 25, but does not disclose a "sharing algorithm." Ma et al discloses "the rendering algorithm is a sharing algorithm" (*first paragraph of section 4: "Currently, the data distributor runs as a single 'host' process that determines the partitions of the data set, reads the data set piece by piece from disk and distributes it to a set of 'node' processes that perform the actual rendering and compositing."*).

41. Lengyel et al and Ma et al are analogous art because they are from the same field of endeavor/similar problem solving area: computer graphics. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to distribute the grouping unit, rendering processing unit, and consolidation unit disclosed by Lengyel et al across a plurality of

image processing apparatuses as taught by Ma et al. The motivation for doing so would have been to accelerate rendering as stated by Ma et al in the first paragraph of section 1. Therefore, it would have been obvious to combine Lengyel et al with Ma et al to obtain the invention specified in claims 9-14, 17, 18, 23, 24 and 27.

42. **Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lengyel et al in view of Ma et al and in further view of Jerrell Watts, Stephen Taylor, "A Practical Approach to Dynamic Load Balancing," March 1998, IEEE Transactions on Parallel and Distributed Systems, v. 9 n. 3, p. 235-248.**

43. With regard to claims 15 and 16, the combination of Lengyel et al and Ma et al shows the limitations of parent claims 13 and 14, but does not show rendering processing load assigned corresponding to network distance. Watts et al teaches a task is assigned to a plurality of the distributed devices, each of which has different network distance corresponding a task's transfer cost (*fourth paragraph of section 5.2: "In the first case, a task's transfer cost was taken to be the change in the distance from the actual location of its data structures to its proposed new location: i.e. the transfer for task i was…where dist is a function which gives the network distance between any two computers…"*). One of ordinary skill in the art would recognize that the level of detail is directly related to the amount of data and the transfer cost of the object to be rendered from the statement by Ma et al in the second paragraph of section 6: "For example, a processor tracing through empty space will probably finish before another processor working on a dense section of the data."

44. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the network distance based load balancing method taught by Watts et al to

distribute the rendering tasks disclosed by the Lengyel et al and Ma et al system according to transfer cost. Ma et al suggests in the third paragraph of section 6, "Performance of the distributed workstation implementation could be further improved by better load balancing"; thus, the motivation for doing so would have been to improve the performance of the rendering system. Therefore, it would have been obvious to modify the Lengyel et al and Ma et al combination with Watts et al to obtain the invention specified in claims 15 and 16.

45. **Claims 7, 30, 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,016,150 to Lengyel et al in view of U.S. Patent No. 5,867,166 to Myhrvold et al.**

46. With regard to claim 30, Lengyel et al discloses the limitations of parent claim 1, but does not disclose the grouping in such a manner that the subspaces overlap. Myhrvold et al discloses "the grouping unit groups the three-dimensional objects into groups in such a manner that the subspaces, each of which contains the three-dimensional objects belonging to the same group (*lines 43-46 of column 4; lines 18-24 of column 9*), overlap one another" (*lines 26-27 of column 9: "Geometry that overlaps a chunk boundary is preferably referenced in each chunk it is visible in."*).

47. With regard to claim 32, Lengyel et al discloses the limitations of parent claim 1; however, Lengyel et al does not expressly disclose per-pixel Z values. Myhrvold et al discloses "the rendering processing unit generates the independent image data for each subspace, the independent image data having per-pixel Z values indicating depth information on a pixel by pixel basis" (*lines 37-41 of column 67: "...and Z is the Z-value which represents the depth of the pixel from the eye point..."; lines 15-18 of column 36: "In order to dramatically reduce memory*

requirements to process graphics images using chunking, a small Z-buffer (e.g. about 4 kilobytes (kb) is used in the illustrated embodiment."); "and the consolidation unit generates the final output image data to be displayed by performing Z-merge processing of the image data generated for each subspace according to the per-pixel Z values" (*lines 12-16 of column 66: "To perform hidden surface removal, the pixel engine 406 compares depth values for incoming pixels (fully covered pixels or pixel fragments) with pixels at corresponding locations in the pixel or fragment buffers."*).

48. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the chunking architecture disclosed by Myhrvold et al as the rendering process in the method and system disclosed by Lengyel et al. The motivation for doing so would have been to obtain the advantages enumerated by Myhrvold et al in lines 30-67 of column 9, furthermore Lengyel et al suggests using the chunking architecture in lines 34-39 of column 16: "The rendering process can be implemented using convention 3D graphics rendering techniques, or a chunking architecture as set forth in U.S. Pat. No. 5,867,166." Therefore, it would have been obvious to combine Lengyel et al with Myhrvold et al to obtain the invention specified in claims 30 and 32.

49. Claim 7 is met by the combination of Lengyel et al and Myhrvold et al, wherein Myhrvold et al discloses "the consolidation unit corrects dynamic range of a depth value of each pixel of the image data generated for each subspace (*lines 31-34 of column 15: "The image preprocessor sorts objects in Z-order, i.e. in distance from the viewpoint. In addition to sorting objects, it sorts gsprites in depth order as well and stores this depth data in the gsprite data structures."; lines 37-41 of column 67: "...and Z is the Z-value which represents the depth of the*

pixel from the eye point... "), and consolidates the image data by comparing the corrected depth value and generates the final output image to be displayed" *(lines 12-16 of column 66: "To perform hidden surface removal, the pixel engine 406 compares depth values for incoming pixels (fully covered pixels or pixel fragments) with pixels at corresponding locations in the pixel or fragment buffers. ").*

50. Claim 31 is met by the combination of Lengyel et al and Myhrvold et al, wherein Lengyel et al discloses "the grouping unit groups the intersecting three-dimensional objects, to each of which a different rendering strategy is applied, into the separate groups" *(Figure 4B shows intersecting objects assigned to separate layers; lines 54-59 of column 10 (emphasis added): " FIG. 4B shows these objects and their sprites in a subsequent frame of animation. Note that splitting the objects to separate layers improves the likelihood that each sprite can be re-used in subsequent frames because the appearance of the objects in each sprite does not change substantially from FIG. 4A to FIG. 4B. ").*

Response to Arguments

51. Applicant's arguments with respect to all previously presented claims have been considered but are moot in view of the new ground(s) of rejection necessitated by Applicant's amendment.

Conclusion

52. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Repko whose telephone number is 571-272-8624. The examiner can normally be reached on Monday through Friday 8:30 am -5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ulka Chauhan

JMR

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